

Physiology labs for blood (4)

Packed cell volume (PCV)

&

Erythrocytes sedimentation rate (ESR)



المجموعة السابعة

دفعته 33 طب بشري

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1st Packed cell volume (PCV)

PCV - also known as hematocrit - is the percentage of red blood cells in circulating blood

PCV test is done by separating the whole blood by the centrifuge into plasma & RBCs , then the amount of RBCs is divided by the amount of the whole sample to give the percentage of the RBCs in the blood. **Normal range in male = 42-50% , in female = 35-45%**

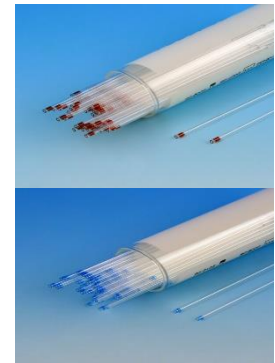
PCV increases in **polycythemia** , and it decreases in **anemia**.

Tools used in this test :

1- capillary tubes, there are 2 types of them

A - red capillary tube :- contains anti-coagulant so we can fill them with blood directly from the capillary

B - blue capillary tube :- does not contain anti-coagulant so we have to fill them with blood that is already collected in EDTA tube



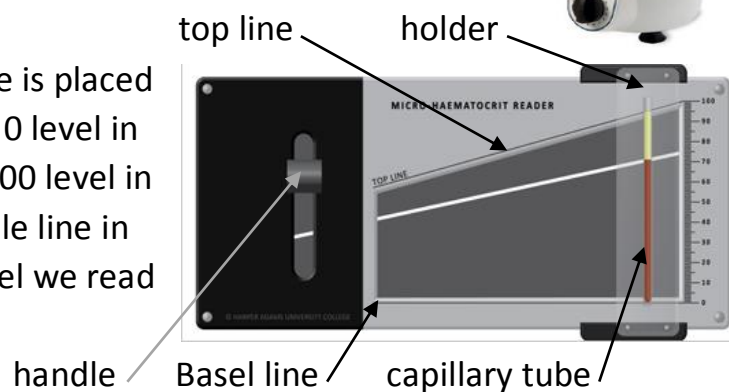
2-capillary tube centrifuge

separates blood into RBCs and plasma in the speed of 12,000 round per minute



3- reader

used to calculate the PCV easily , the capillary tube is placed on the holder with the bottom of the RBCs at the 0 level in the Basel line , and the top of the plasma at the 100 level in top line , then with the handle we make the middle line in between the RBCs and the plasma then at this level we read the percentage of the RBCs.



* unlike HB estimation , we don't use any reagent because we need the RBCs to be intact and not destroyed , and if pink or red color appears in the plasma it means some RBCs are destroyed and the result will not be accurate

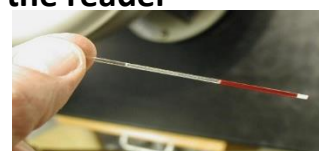
Steps

1-use the lancet to puncture the skin to enable the capillary blood to exit to surface of the skin, we prefer to use the index & middle fingers because they have thin skin

2- fill $\frac{2}{3}$ up to $\frac{3}{4}$ of the capillary tube with blood , then close it from the empty side with clay or with fire , in the lab we use the fire so be careful not to burn the blood because that will destroy the cells and the result will be wrong.

3- put the capillary tube in centrifuge for 5 minutes at speed 12,000 RPM , the tube is placed in the centrifuge with the closed end directed to the outside

4- using a ruler , measure the RBCs for example 2.5mm and the whole blood for example 5mm then divide $\frac{RBCs}{whole\ blood} = \frac{2.5}{5} = 0.5 \times 100 = 50\%$, or you can simply use the reader



2nd Erythrocytes sedimentation rate (ESR)

Erythrocyte sedimentation rate (ESR) is the rate at which the erythrocytes settle down in one hour. Normally, the red blood cells (RBCs) remain suspended uniformly in circulation. This is called suspension stability of RBCs.

If blood is mixed with an anticoagulant and allowed to stand in a vertical tube, the red cells settle down due to gravity with a supernatant layer of clear plasma.

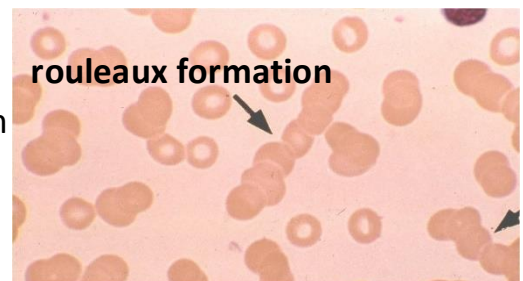
ESR test is not a specific test because it gives us the degree of the infection but not the type of the infection and it is directly proportional to the degree of the infection.

Normal range in male :up to 10mm/hour & in female up to 20mm/hour

ESR increase in the infections due to

1 change in polarity of the components of the blood as a result of change of plasma proteins during infection

2 these changes alter the suspension stability of RBCs causing the RBCs to get closer from each other and form the rouleaux formation which is heavier than normal RBCs so they are pulled down by the gravity faster



Steps of this test

1 mix the EDTA tube containing the blood

2 fill the base of the ESR tube with blood up to this level

3 press the ESR tube on its base making the blood go up until it reaches the top of the tube at the 0 level

4 place the tube vertically and let it stand for one hour

5 after one hour, read the tube to see how much of the blood has settled

Common mistakes in this test

1 placing the tube obliquely or horizontally and not vertically

2 shaking the tube, both of these mistakes accelerate the process and give wrong results

***although we took them in the same lab PCV & ESR are very different tests used for different causes**